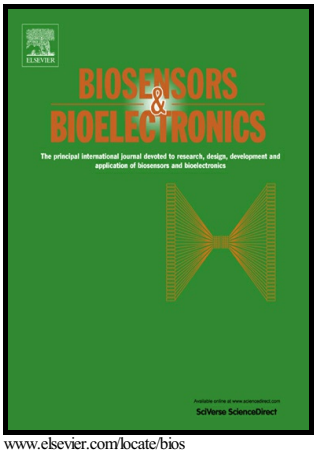

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PII: S0956-5663(18)30178-7
DOI: https://doi.org/10.1016/j.bios.2018.03.014
Reference: BIOS10340

To appear in: *Biosensors and Bioelectronic*

Received date: 1 January 2018
Revised date: 16 February 2018
Accepted date: 6 March 2018

Cite this article as: Bhawana Thakur, Guihua Zhou, Jingbo Chang, Haihui Pu, Bing Jin, Xiaoyu Sui, Xiaochen Yuan, Ching-Hong Yang, Matthew Magruder and Junhong Chen, Rapid Detection of Single *E. coli* Bacteria Using a Graphene-based Field-Effect Transistor Device, *Biosensors and Bioelectronic,* https://doi.org/10.1016/j.bios.2018.03.014

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ABSTRACT

Contamination of surface and drinking water due to the presence of *Escherichia coli* bacteria is a major cause of water-borne disease outbreak. To address unmet challenges for practical pathogen detection in contaminated samples, we report fabrication of thermally reduced graphene oxide-based field-effect transistor (rGO FET) passivated with an ultrathin layer of Al_2O_3 for real-time detection of *E. coli* bacteria. The sensor could detect a single *E. coli* cell within 50 s in a 1μL sample volume. The ultrathin layer of Al_2O_3 acted as a barrier between rGO and potential interferents present in the sample. *E. coli* specific antibodies anchored on gold nanoparticles acted as probes for selective capture of *E. coli*. The high density of negative charge on the surface of *E. coli* cells strongly modulates the concentration of majority charge carriers in the rGO monolayer, thereby allowing real-time monitoring of *E. coli* concentration in a given sample. With a low detection limit of single cell, the FET sensor had a linear range of 1-100 CFU in 1 μL volume of sample (i.e., 10^3 to 10^5 CFU/ mL). The biosensor with good selectivity and rapid detection was further successfully demonstrated for *E. coli* sensing in river water. The rGO-based FET sensor provides a low cost and label-free